SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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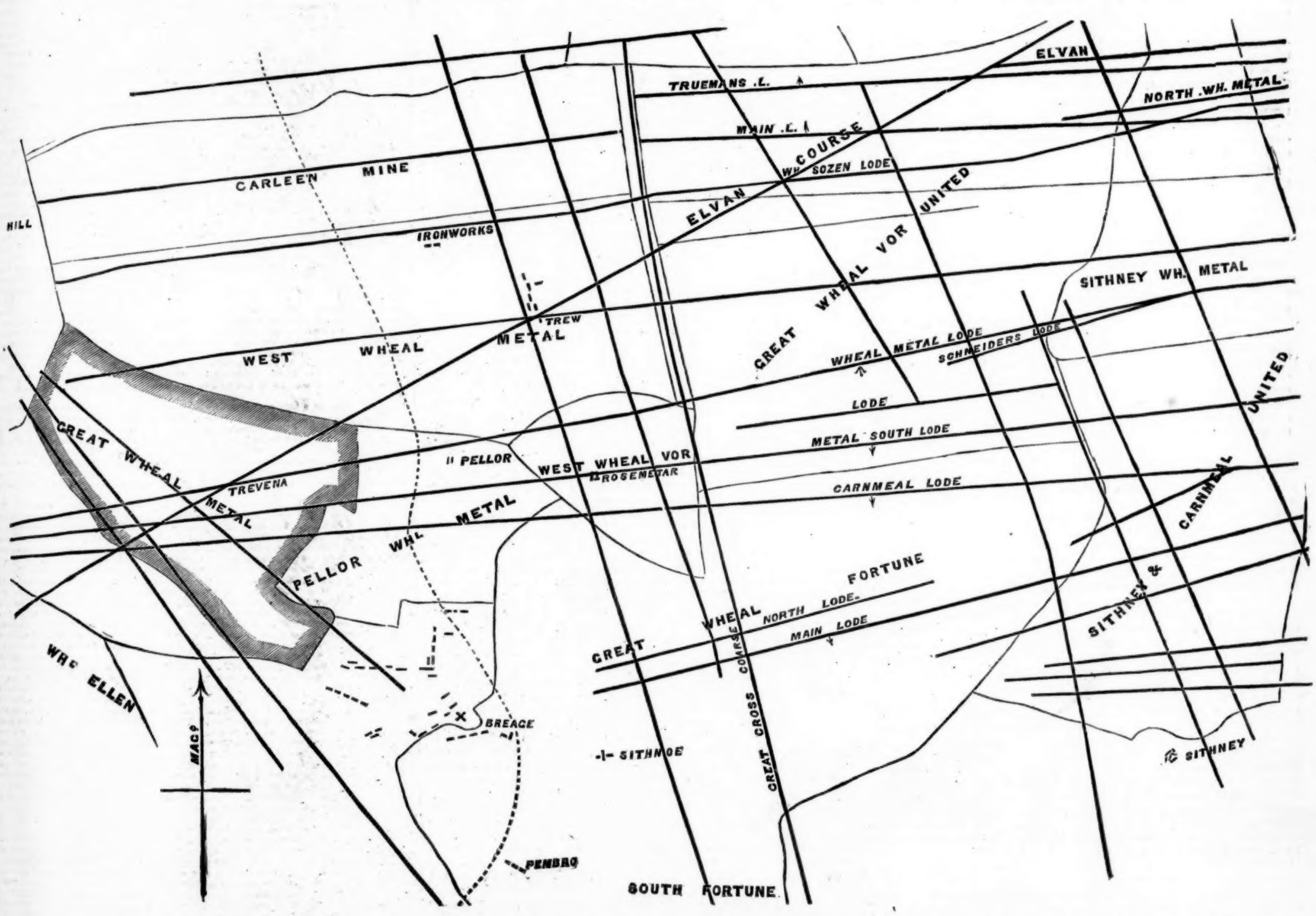
PLAN OF THE GREAT WHEAL VOR MINING DISTRICT.



Great Wheal Metal.—The country may fairly congratulate itself upon the improved and improving condition of mining industry: there was a time when a certain feeling of distrust was directed towards this most important business; a miner was not looked upon as so worthy of credit as some members of other professions, and if the truth must be told the dictum of capitalists was—Oh! if it is a mine, I will have nothing to do with it. Amongst our advertisements will be found the prospectus of a new mine, to be worked in the district of the now famous and rich Wheal Vor and Wheal Metal; and it is unhesitatingly said, the high character of the gentlemen connected with the undertaking would be sufficient to float the heaviest project, or the most important affair, that might require the support of British capitalists. No doubt the intrinsic merit of the thing itself, situate as it is in the midst of the greatest and richest mines of Cornwall—such as Wheal Fortune, Great Work, Wheal Metal, and Wheal Vor—has much to do with the respectability of the selected list of guardians who are prepared to conduct this new mine into existence, and to support its claim to public favour afterwards through its incipient stages to maturity; but we cannot close our eyes to the fact that the spirit of mining for national purposes is reviving, and affords a prospect of the great and progressing prosperity of the whole country, and of all its lines of commerce.

Progress in Spain.—Some official documents, brought down only to 1860, it is true, but still interesting, show that mining and metallurgy in Spain had even then attained more importance than might, perhaps, be supposed. The number of mines worked in Spain in 1860 was 1988, while the whole number of mines conceded was 8294. The aggregate staff of workmen employed was 28,554, and 39 steam-engines were at work in this department of the national industry. The quantities of minerals obtained from Spanish bearings were as follows in 1860:—Iron, 175,503 tons; lead, 316,819 tons; silver, 4230 tons; copper, 146,003 tons; tin, 7 tons; zinc, 108.802 tons; mercury, 8041 tons; asphalte, 63 tons; cobalt, 3·6 tons; antimony, 60 tons; manganese, 28 863 tons; turf, 130 tons; common salt, 64 tons; soda, 17,557 tons; sulphur, 23,045 tons; coal, 321,773 tons; and lignite, 17·531 tons. The products obtained in the various works were:—Iron, 41.138 tons; lead, 82,498 tons; copper, 2705 tons; tin, 3·8 tons; zinc, 1853 tons; mercury, 40 tons; asphalte, 200 tons; antimony, 3·4 tons; common salt, 7225 tons; soda, 3316 tons; alum, 1380 tons; and sulphur, 37,101 tons. The products obtained in 1860 in the establishments of the State were of the following amount and value:—Mercury, 738 tons, 135,599*l.*; copper, 904 tons, 71,283*l.*; lead, 2226 tons, 32,048*l.*; sulphur, 19 tons, 346*l.*; salt, 391,692 tons, 1,112,842*l.* The taxes levied on mines to the number of 6795, the demarcations of which had been made, were as follows in 1860:—Landed contribution—sum due, 17,221*l.*; sum collected, 13,517*l.* Contribution of 3 per cent. on minerals sold—sum due, 3650*l.*; sum collected, 3553*l.* Proportional *droit* for the minerals worked—sum due, 27,273*l.*; sum collected, 24,849*l.* The number of mineral-treatment works of various kinds in activity in Spain in 1860 was 345, while 255 were idle. The number of workmen employed was 8171; of hydraulic engines, 372; of steam-engines, 104; of furnaces, 803; and of forges, 280. There is only one defect about these statistics, and that is that they stop short Dec. 31, 1860, nearly 3½ years since. In that period enterprise of every description has made rapid strides in Spain, from the completion of great arterial lines of railway, the development of institutions of credit, and the increased inclination which the upper classes have manifested for industrial pursuits, as opposed to idleness, politics, or war. Coal has hitherto been selling at 3*l.* per ton at Madrid, but come a few years of peace and progress, and it will be an article of easy and general consumption. This in itself is a matter of no small importance. For what in these times can be accomplished without the "bread of industry," as coal has been so happily termed?

The Copper Trade.—Mr. J. Pitcairn Campbell, of Liverpool, in his report, says:—Smelters, without publishing any reduction, having accepted below their quotations a large quantity of copper has changed hands, at 4*l.* to 5*l.* below tariff rates. Amongst other sales, 1000 tons have been booked for India, at 100*l.* Importers, too having freely met the demand, I have to report a very large business in ore and regulus, on the spot, and to arrive, at 17s. per unit. Since my last the the transactions are—

April 30.—	550	tons	bars to arrive per "Jane Blythe," at	£88	0	0	per ton.
May 2.—	85	„	Knockmahon ore, by tender	0	17	4	per unit.
	65	„	„ „	0	16	4	„
	65	„	Welsh „	0	16	0	„
May 3.—	417	„	regulus, per "Martha Jackson"	0	17	0	„
May 5.—	640	„	ore, per "Georgina Grenfell," Swansea	0	17	0	„
	308	„	regulus, "Mohican"	0	17	0	„
	206	„	regulus, "C. Lambert"	0	17	0	„
May 12.—	130	„	regulus, "Knight Templar"	0	17	0	„
	630	„	regulus, } "Guayacan," to arrive	0	17	0	„
	35	„	ore, }				
	650	„	ore, "Caldera"	0	17	0	„
	610	„	ore, "Mary Lee," Liverpool	0	17	0	„
	485	„	regulus, "Chiloe"	0	17	0	„
May 13.—	1200	„	ore, "Western Star"	0	17	0	„
	480	„	ore, "Inca"	0	17	0	„
	222	„	regulus, "Pathfinder," Swansea	0	17	0	„
	575	„	regulus, ex "Rose of England," Swansea	0	17	0	„
	487	„	regulus, "Copiapo"	0	17	0	„
	465	„	regulus, "Coquimbo"	0	17	0	„
	65	„	bars, to arrive per "Santa Rosa"	89	0	0	per ton.
May 14.—	270	„	regulus, per "Montizuma," Liverpool	0	17	0	per unit.

Quotations are—Ore and regulus, 17s.; bars, 88*l.* to 89*l.*; barilla, nominal. The stocks of Chili in first and second hands likely to be available are—

Ores.	Regulus.	Bars.	Barilla.
2040	1120	2420	110

Arrivals since my last have been from the West Coast—

	Ores.	Regulus.	Bars.	Barilla.
"Hayti," Colon	—	—	45	—
"Lady of the Lake," Valparaiso	—	312	130	—
"Elizabeth Martin," Valparaiso	—	470	60	—
"Inca," Cobija	490	—	—	85
"Conheath," Arica	—	—	—	35

ON THE MECHANICAL AND CHEMICAL TREATMENT OF GOLD AND OTHER METALS.

Mr. James D. Whelpley, in a letter to Professor B. Silliman, jun., says —Agreeably to your request, I send you herewith a few memoranda in explanation of our new process for preparing quartzose ores of gold for amalgamation. This process, so far as I am aware, together with all the machinery employed in it, was invented and constructed by Col. J. J. Storer and myself. Our researches in this direction began in the spring of 1860, in Philadelphia. We experimented for several months upon a small scale, testing most of the then known processes for reduction and desulphurisation of ores. It then appeared to us that processes requiring long periods of time, such as are employed by skilful chemists in the laboratory, could not be applied to large mining operations, where masses of several tons have to be treated at one operation. A few grains of sulphuret of iron or copper heated to whiteness in a platinum capsule will be thoroughly desulphurised, but a mass of ore weighing several thousands of pounds cannot be handled in this manner. The ore fuses in the furnace, taking the form of slag, and holds the sulphur confined in its substance.

If, on the other hand, the finely pulverised ore be spread thinly over a hearth 14 ft. in length, and 8 or 10 ft. in diameter, with free access of air, and the heat either radiated from the roof or passing up through the hearth of the furnace, a very thorough desulphurisation may be effected by constant turning and exposure of fresh surfaces, taking care that the temperature does not exceed a cherry-red heat. A large access of atmospheric air is necessary for the management of this process, and it is aided by the addition of chloride of sodium, and other reducents. Though perfect in the end, it is exceedingly expensive and tedious, because of the care required in regulating temperature and handling of the material. The results of the experiments with this last process were, however, very valuable to us. We discovered that the first condition of thorough desulphurisation was the reduction of the ores and sulpurets to an impalpable powder. The reason of this is evident—that the effect of heat upon a particle increases inversely as the square of its diameter. Microscopic atoms are readily acted upon by combined air and moisture at a cherry-red heat. Pieces of the size of mustard seed will resist the action of the best-managed furnace for hours, and the difficulty increases with the size of the particles directly as the squares of their diameters.

A theoretically perfect process, therefore, requires:—1. That every particle shall be microscopically small—in the condition of fine, floating dust. —2. That the particles do not touch each other while hot.—3. That when metallic grains, as of gold or copper, have to be separated from the ore, the contact of water with the heated particles is necessary.

We constructed a furnace, in which finely pulverised ore-dust was floated in a current of hot-air and flame, passing down through a flue leading from a hard coal fire, at an angle of about 45°, and then resting upon a horizontal hearth or sole. We discovered at this time that moisture, or the vapour of water in large quantities, materially aided the process of desulphurisation in free air, and we constructed and applied a steam apparatus, by which a volume of steam was made to pass down the inclined flue with the ore-dust, the atmosphere, and the products of combustion. At this point we encountered several serious difficulties. The inside of the inclined flue became lined with stalactoid masses of semi-fused ores, and the sole of the furnace caked and covered with the same. When a certain quantity of burnt ore had accumulated on the hearth, a trap was opened, and the heated mass pushed through into a water-bath. The agglutinated masses, on being withdrawn from the bath, were re-ground, and passed a second time through the furnace.

A sufficiency of atmospheric air could not be applied through the furnace-doors, and a very large percentage of the ores escaped through the chimney into the open air. The last of these difficulties was overcome by placing a powerful fan-wheel of copper (which served also as a water or spray-wheel) in the chimney itself, or in a chamber of it, and by carrying the horizontal flue some 75 ft. beyond this wheel. The steam from the furnace and the spray from this wheel, working over a pool of water which formed the floor of a horizontal flue, effectually wetted down and saved the flying dust of ore.

The brick floor or sole of the furnace was abandoned, and a water-floor substituted. Over one end of this pool or water-hearth, a perpendicular flue was erected, from 12 to 15 ft. in height above the surface of the water. The flames of four fires were poured into the top of this flue by the effect of two fan-wheels: the first, the copper spray-wheel already spoken of; the other, an auxiliary fan-blower, sending air into all the fire-boxes. The top of the furnace was left open, and a column of air, bearing pulverised ore, driven directly from the pulverising mills, down through the centre of the perpendicular flue.

The operation of this machinery balanced and regulated the force of the draft so well, that while ore-dust was driven in at the rate of 1200 lbs. an hour, carrying with it an excess of atmospheric air, if a side-door of the descending flue were opened, a feather would float in the opening without being blown either way.

We then discovered that the immediate quenching of the fused particles of ore, by the water in the pool and in the chamber beyond, was essential to a thorough separation of the metals. The heated particles on touching the surface of the water are exploded into still minuter fragments, a degree of fineness unattainable by any other means. The entire apparatus is constructed with a view to this result. The water lining the bottom of the flues is a circulation completed by an outside canal. The water thrown up from the copper dash-wheel, returning circuitously, falls back into the furnace-pool. This water, after some time working of the furnace, is, of course, charged with sulphates of iron, copper, and other metals. The insoluble metal falls to the bottom with the sediment, which is composed chiefly of silica and iron. In this sediment the gold will be found ready for washing and amalgamation.

The sediment is drawn out by the workmen, as fast as it accumulates, through the submerged arches on which the brick-flues or water-chambers are established. The condition of the sediment is that of a smooth plasma, without grit or coarseness of grain. Using only floating dust, 10 tons can be worked in 10 hours with these results, in a furnace of the size indicated. More extensive machinery would give larger returns. We built our flues and water-beds under the furnace, and also under the horizontal brick archway leading therefrom to the spray-wheel, of common brick, thickly covered with ordinary hydraulic cement. We found this a very good lining for the descending flue, or "drop." The spray-chamber beyond the dash-wheel was built of wood, over a brick and wooden water channel 75 ft. long, 6 ft. wide, from 20 to 30 ft. high. This was filled with vapour of water and sulphurous acid from the furnace pools, which made a fine rain, carrying down any minute ore-dust which might escape the action of the dash-wheel, also condensing large quantities of sulphuric acid from the sulphurets. The gold ore most free from sulphurets are easily worked. When the sulphur is in excess, the supply of air and moisture must be proportionately large. In regard to fuel, the finer the ore-dust before burning the more economical the process. In places where wood alone is accessible for fuel, the fire-boxes should be from 20 to 30 in. deep below the fire-bridges; 8 in. for coal.

CRUSHING MACHINERY.—For crushing gold ores previous to fine grinding any ordinary crushing machinery may be employed that will reduce them to pea or gravel size, as they must not be larger than this before entering the pulveriser. The crushing-mill used by us is a patented invention of my own. It consists of a very heavy and solid bar of wrought-iron, revolving in the bottom of a cast-iron tub as close as possible to the sides and bottom of the tub. This bar carries at either extremity a hardened steel or chilled iron plate, with a cutting edge welded to a soft iron back to prevent rupture. The sides of the tub are pierced with holes from 1 in. to ½ in. in diameter, forming a coarse sieve. Two of these bars may be used crossed, working four cutters, held together by a cast-iron centre-piece of great strength and solidity, through which an upright shaft passes, furnished with a step and pulley. The speed of these cutters is a little more than 10,000 ft. per minute. The broken pieces of quartz are thrown out of the holes in the side of the tub at the rate of 5 tons per hour.

PULVERISING MACHINERY.—The pulverising of the crushed ore is performed by flat plates of thin iron faced with chilled iron, attached to radiating arms, somewhat like the paddles of a steamboat wheel. These revolve inside of a cast-iron drum, as close as possible to the sides, and very near its circumference. A horizontal shaft passes through the centre of the drum. The material, gravel size, is poured in on one side at the axis by an automatic hopper, which measures the quantity. A powerful draft of air, forced through the machine by a fan blower, forming an essential part of the apparatus, draws out the dust through a hole on the opposite centre of the drum, where the shaft also passes.

The dust is then carried by this fan-blower, and driven into the top of the furnace. The minimum rate of delivery for a mill of ordinary size is 1500 lbs. an hour. Of this last machine I cannot give you a more minute account, as its successful operation depends upon interior details, obtained by long and costly experiment. The maximum rate of production we have not yet ascertained. All the new and important features have been patented by Col. J. J. Storer and myself. As soon as possible I will furnish you with working plans of the furnaces built and worked by us. We have ground the hardest copper ores of Vermont, and the quartz of Nova Scotia, in our pulverising mills. I know of none more difficult of reducton.—*Silliman's American Journal of Science and Arts.*

THE VENTILATION OF MINES BY MECHANICAL MEANS.

Notes from a Lecture by Prof. W. W. SMYTH, Royal School of Mines, London.

It would occupy an unreasonable length of time to enter fully on all the varieties of machines, devised to effect artificial ventilation. In fact, to enter into the details of the enormous variety of fans alone, would occupy the time of many lectures; it is, therefore, only possible now, to explain the principles on which each class of machines act. When called on to determine the merits of any new machine for effecting ventilation, we may always remember that the object of all such machines should be to produce a large volume of air moving at a low velocity and by its capacity for accomplishing this we may invariably decide the value of the machine submitted to us. Supposing, then, we have a current of air the result of natural or artificial forces, we have to consider the means to be adopted in distributing it, and which subject we will divide into two heads.—1. The means by which the natural current of air shall be assisted.—2. The plan upon which the current shall be carried. Now, under the first of our divisions, let us look at the means by which we may assist the spontaneous ventilation of some workings, and let us take the case of the simplest piece of underground workings—a simple drift, with a perpendicular shaft communicating from the end of the drift to the open country; and let it be required to continue the drift beyond the bottom of the shaft. The air in this new ground will, after a few yards, become stagnant; and if the drift be continued some 60 or 80 ft. it will be impossible for the men to work unless a second shaft be sunk, which may not be feasible from the lie of the ground, and many other reasons; under such circumstances we may easily overcome the difficulty by assisting the natural tendency of the air. Now, the direction of the natural currents in this case will vary with the time of the year; in winter the current will pass in through the drift, and up the shaft, but will not penetrate into the drift beyond; and to force it in there the easiest plan will be to put a door in the drift just before the bottom of the shaft, and to place through the door to the end of the drift to be ventilated an open pipe, which will carry the air to the end, where it will escape, and find its way out from the shaft, and thus purify the extreme end of the drift. For the pipe it may be convenient to substitute a trumpeting, or any other simple form of air-passage.

In the summer the direction of the current will be reversed—that is, it will flow down the shaft and out of the drift; in this latter case, to ventilate the end of the drift beyond the shaft, the easiest plan will be to put a sollar across the bottom of the shaft, and to lead a pipe through the sollar to the close end, which may this way be perfectly ventilated. Now, the ventilation of mine workings on a large scale is effected by the application of the simple principle here described; and the only difference is, that for pipes, sollars, and air-tubes are substituted large air-passages, doors, &c. In considering these larger workings, let us first take the case of two shafts near one another, sunk to a considerable depth, and communicating with one another at the bottom; under such circumstances, the first thing will be to convert one shaft into a downcast the other into an upcast shaft. If the workings are long and intricate, we shall find that the air going down one shaft will make its way by the shortest road to the upcast shaft, and it will become necessary to adopt some means of driving it into the furthest workings. The means usually adopted for accomplishing this is by doors, of various forms and materials. Thus, in the North of England, to prevent the air from escaping too soon, they stop the level by a simple wall of brick, built from the floor to the roof, or by a pile of shale; in such cases, if the roof falls in, the stopping becomes perfect; but if not, these stops are liable to leak, and on this account are very objectionable. A well-built stone wall forms the best of all stops; and we cannot enlarge too much on the importance of these stops, as we owe the great mortality in most of our colliery explosions to the men being killed by the after-damp, let in by the destruction of the badly-built stoppings. It becomes thus the duty of all colliery managers to see that the stoppings in their collieries are kept in a good sound condition, air tight, and capable of withstanding a great explosion. Variations in the usual form of stoppings are sometimes necessary to keep out water or explosive gas; and to make them for such a purpose it is usual to cut a groove in the rock on both sides, and then to put in a wall of strong stone, and where there is inflammable gas to use a layer of well-tempered clay.

Stoppings are usually put in, to be more or less permanent, between old roads or tramways, but sometimes it is necessary to allow of the passage through them of men and wagons, in such cases doors are substituted for permanent stops. Now, of doors there are a variety of kinds. First come main doors, on which great reliance has to be placed. To illustrate their use let us take the case of two shafts, from the bottom of which a variety of workings are carried out, but ultimately communicating, and it becomes necessary to open a direct communication between the two shafts, such communications, would be a good occasion for the use of main doors, which, in such important positions as this, should be double, and between the two there should be sufficient room to take in all the men or wagons required to pass at one time, so that both doors may never be open at the same moment. So much depends upon these main doors that it has been proposed to add to them swing doors, which Mr. Buddle suggests should be kept lying against the roof, and held to it by a catch, from which, when holding the door up, should hang a board, so that when an explosion takes place, the board holding the catch will be blown down, and the swing door immediately fall. The advantages of this idea are obvious. Of other classes of doors, the term shaft-doors are given to those put up in boards, to drive the air in any direction out of the straight course it would follow; these doors need not be so carefully constructed. Again, there are sham doors, which are merely pieces of board placed partially across the level, to turn a part of the current in a particular direction. Man-doors are those to allow the passage of men, and are often made in the stops.

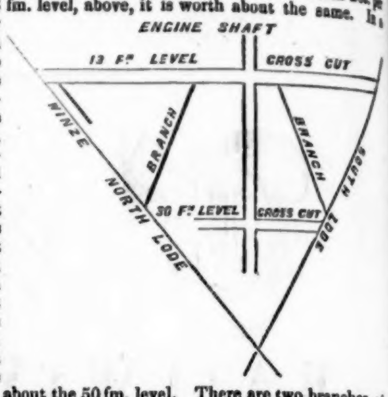
There is still another class of circumstances in which air currents are brought into near contact with one another. For instance, it is often necessary to bring an intake current above the return air-way, and to allow the currents to cross one another without mingling. In some cases this is most wretchedly done, as where the return air-way is only defended from the pure air by the thickness of a wooden box-pipe. Such a system is very dangerous, and ought never to be allowed. Another very objectionable method is to divide the return air-way from the fresh current by a small thickness of earth; thus the return road is sometimes driven up over the main road, and only separated from it by planks and turves; the liability of all such divisions to the destructive force of an explosion is the great objection to them. For these reasons, in a colliery carefully attended to, there are various other modes adopted, and it is never allowed to bring the return air-way near to the intake channel; there is, in fact, such a thickness of strata left between the two air-ways that there is no fear of its being destroyed. Another good plan, where the last mode is not feasible, is to build a strong archway as a division between the two air-ways; such an arrangement answers well where the force exerted on the arch is only external, but if the force be internal such an arch will not stand. In Lancashire, they make a good crossing of boiler-plates and sheet-iron. In connection with the subject of crossings, it is proposed to do away with the method of allowing the return air-way to be brought near the workings being then carried on, the endeavour being to carry the return air from the lower seams by special air-ways to the higher seams, thus taking advantage of the natural tendency of the air to rise.

LARGE MASS OF NATIVE COPPER.—Mr. J. B. Townsend, agent of the Minesota Mine, has communicated the following facts regarding the large mass of copper found in 1857:—"The great mass of the Minesota Mine was discovered in Feb., 1857, between the adit and 10 fm. level, or about 120 ft. below the surface. It was embedded in the belt of conglomerate which forms the footwall of the Minesota vein. Previous to its discovery, the regular vein, at the junction of the trap and conglomerate, had been removed. The footwall of the vein, at the place where the great mass was found, was perfect and regular as in other cases; the lode was also rich in mass copper. The great mass was discovered only by small strings or pieces of copper extending into the conglomerate. The mass itself was 45 feet in length, about 22 ft. at the greatest width, and thickest part more than 8 ft. It was over 90 per cent. copper, and weighed about 420 tons. It required 13 months to complete the cutting up and sending it to the surface. Some 30 men were employed in cutting at first, but as the piece became smaller only a few could work at the cutting at a time. Several heavy blasts were necessary to loosen the mass from its bed. At the last blast, or charge, 30 kegs of powder (750 lbs.) were used. The whole amount of powder consumed in the various trials was 95 kegs (2375 lbs.) The principal features of this mass of more than ordinary interest were its great weight in one solid body, its remarkable purity, and its occurring outside of the regular vein in the conglomerate rock."—*Silliman's American Journal of Science and Arts.*

CARN CAMBORNE.

The following has been furnished us by Mr. T. E. W. Thomas:—

The south lode lately intersected by the 30 cross-cut is worth 20*l.* per fathom. In the 13 fm. level, above, it is worth about the same. In a winze sinking below the 13 fm. level on the north lode, to come down on the 30 fm. level cross-cut north, the lode is large, very kindly, and orey throughout. The annexed section will show:—



It will be seen that the lode south has been intersected at the 13 and 30 fathom levels, and is worth 20*l* per fathom at each point. The north and south lodes are expected to intersect or unite with each other at about the 50 fm. level. There are two branches, of a very kindly nature, partially worked near the surface by the old workers *within* the two main lodes, and the whole are, apparently, making together in depth. Few mines have such prospects as are here, and, taken with the well-known character of the district, the mine will, in all probability, soon prove itself a very valuable property.

FUEL.

Petroleum has now attained so important a position as an article of commerce, and its inflammability and heating power are so well known, that it is quite natural it should have been proposed as a substitute for coal on board steamships and in railway engines. In the districts where earth oil is found it is taken from the ground (or, rather, from wells sunk below the surface) in the same manner as if it were water. The sources of supply are not, perhaps, inexhaustible, but in Pennsylvania, Canada, and Burmah they are immeasurable. Yet petroleum is now quoted at 20*l.* a ton in Liverpool, and the crude article sells for nearly half this price in New York. This price is in a considerable degree accounted for by the fact that only a comparatively small number of oil wells have yet been opened, although the cost of bringing petroleum to market forms, in itself, a large portion of its final cost. It is most likely that the supply will become more abundant, and that, notwithstanding the bulky nature of the article, its transport may yet be effected at a greatly diminished cost. But even at one half its present price it would be out of the question to think of employing petroleum on a commercial scale as fuel. Its heating value, ton for ton, is about twice that of coal. This proportion is said to have been approximately ascertained by trials in America, and it is, furthermore, about what might have been calculated from the known chemical constitution of earth oil. Equal weights of different kinds of fuel have a heating power exactly corresponding to the weight of oxygen with which they respectively combine. Coke is nearly pure carbon, and it combines with less than three times, or, more exactly, two and two-thirds times its weight of oxygen, the product of its perfect combustion being carbonic acid. Thus a ton of coke should form three and two-thirds tons of carbonic acid, and the quantity of the last-named gas may be taken as representing the ultimate calorific efficiency of the fuel. Now, pure hydrogen is the most powerful heating agent known. A ton of it—to keep up the standard of comparison already employed—combines with eight tons of oxygen, forming nine tons of aqueous vapour, and this, in a comparison of heating value, may be treated as so much carbonic acid. Pure hydrogen, therefore, has exactly three times the heating power of coke or pure carbon. Petroleum is a hydrocarbon; its composition being such that its heating power is nearly a mean between that of carbon and hydrogen respectively. If coal be burnt with the same evaporation of water per pound as with coke, then a pound or a ton of petroleum can only evaporate twice as much water as may be converted into steam by a pound of coal. The result is, therefore, that to burn petroleum at 20*l.* per ton would be as extravagant as coal at 10*l* per ton, and if the former were sold as low even as 5*l.* it would be as dear as coal at 50*s.* The earth oil has an advantage in occupying less space as compared with an equal weight of coal in its ordinary loose state. Yet the difference can hardly be very great, while in some cases, with coal in large lumps, its weight is greater in proportion to its bulk, or, in other words, its specific gravity is greater than that of petroleum. The cost of coal on distant naval stations is greatly enhanced by the freight, and indeed this forms nearly the whole of the difference between coal at from 8*s.* to 15*s.* a ton on our own coasts, and 2*l.* 10*s.* in the East. In this respect petroleum should possess a considerable advantage, as the transport of one ton to a distant station would cost but half as much as that of a quantity of coal of equal heating value.

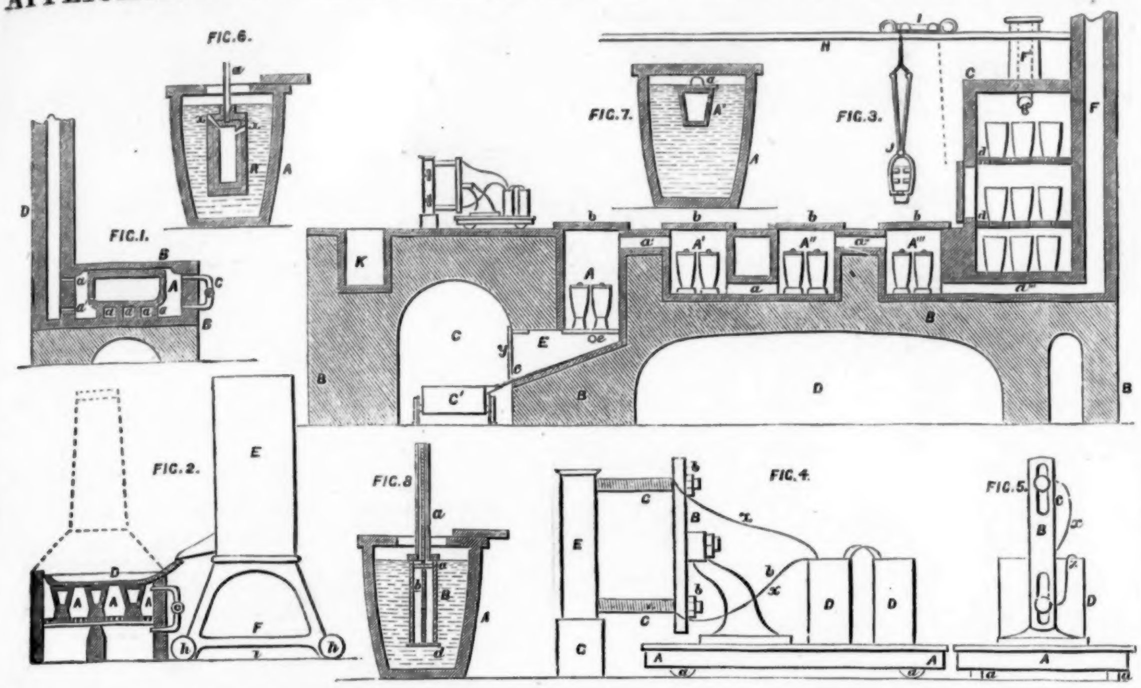
We are, however, a long way from the possession of mechanical means whereby the safe and efficient combustion of petroleum may be effected. We have first to make sure of its proper storage on board ship, and then to contrive its graduated admission to the fireplace. It should be admitted, probably, in trickling streams, as from the rose of a watering-pot, and be thus spread and burnt over a surface of incandescent coke or fire-brick. This, we believe, has been found to be the best mode of burning petroleum thus far. Until, however, the market price is greatly reduced, or until there is some strong probability of an early and considerable reduction, any attempts to burn oil for heating purposes must be premature.

As for peat, we cannot place great faith in its extensive introduction as a fuel. The vast quantity of water which it contains in its ordinary state greatly increases the cost of bringing it to bank. The machinery, and great amount of power required to bring it into a useful form, imply also a serious increment of cost. Of the advantages of peat when ready for burning there can be no doubt; its freedom from sulphur makes it a valuable article of fuel for many purposes, but the great consideration of cost will always, it would seem, arise to prevent its competing to any considerable extent with coal.

There is another direction in which efforts for promoting economy in combustion might well be turned. It is that of burning coal in the gaseous rather than in a solid state. Not merely the hydrocarbons may be expelled from coal, but by a graduated admission of air the solid carbon may be converted into carbonic oxide, to be conveyed to the fireplace where heat is required. In Mr. Siemens' gas furnaces breeze, or other inferior coal, is wholly gasified in separate and nearly close vessels, called "producers," and from these the hydrocarbons and carbonic oxide are led to the heating furnace, where they are met and inflamed by air previously heated in fire-brick "regenerators" to perhaps 3000°. The admission of both the gas and the air is under perfect control by means of dampers, and the result is a flame which may be constantly maintained at any desired point, and without the slightest production of smoke. Not only are these most desirable results attained, but the stocker has only to shovel or shoot the fuel down a channel where the heat is not great, and where no clearing of fire-bars is required, and were, also, the admission of a little cold air is attended with no harm. This system of gas furnaces is at work in the establishment of the Patent Enamel Company, at Birmingham, and the results are such as to leave no room for doubt that the same system might be applied with great advantage to vast number of purposes where high and uniform heats are necessary. As for smoke, which is wholly avoided by the gas furnace, the suppression of such a nuisance would alone be worth the cost of a complete change in our heating arrangements. In the factories where fuel is now burnt in the gaseous state, and with the employment of regenerators, the saving of fuel—and this saving is a considerable one—has proved of even less importance than the advantage obtained in equal and clear heats, and in freedom from smoke. The gas may be burnt with or without excess of air, so that if necessary, a heat may be taken on a pile of iron or an ingot of steel without the presence of free oxygen, and therefore, without any danger of burning the metal. This advantage is of immense consequence in the working of large masses. With plates or ingots once cleaned, or with the application of borax to form a fluid cinder, any weight of iron might be allowed to remain in the furnace, and to become heated gradually through without any danger of burning. On the removal of the fuel the joints would be free from scale, and the whole could be welded up at once, with the certainty of soundness at all parts. There is not an invention which, at the same stage of working, promises more important results. In many cases, too, the gaseous fuel would be of great advantage, by reason of the facility with which it may be purified from sulphur by passing it through lime. It would thus be quite possible, with a fuel which would be otherwise almost worthless, to obtain a heat adapted to the most important purposes of metallurgy.—*Engineer.*

EXTRACTING GOLD FROM SLUDGE.—The Great Extended Company (alluvial), Ballarat, has introduced, with considerable success, the use of the simple Cornish Buddle for the purpose of concentrating the sludge after it leaves the puddling machines. In four weeks 16 ozs. of gold were saved that would, otherwise, have gone the way all other sludge has gone before, and is doing now in every other locality. This saving was effected at a cost of 4*l.* 10*s.* per week, leaving a clear profit of 48*l.* on the month's operations. The result is such as to recommend the system for general adoption. The operation is an extremely simple one, and merely requires the attention of two men. The sludge from the machine is brought in a shoot to the outside of the building, and discharged into a small tailings pit, from whence it makes its exit again on the other side of the pit, by a long shoot that connects with the ordinary sludge channel. The sludge, as it leaves the first shoot, and falls into the pit, is met by a jet of water, that precipitates all the heavier portions. The precipitated sand in the pit, as well as that deposited for a considerable distance down the second shoot, is wheeled up in barrows to the side of the buddle. The buddle may be described as a small table, narrow at the top, and widening out to the other end, having lozenge-shaped buttons fastened on its surface at regular intervals. The sand collected is fed into a small shoot at the upper end, and the water turned on. The stuff flows over the table, the buttons having the effect of distributing the water over the whole surface, and well washing the sand. From the table the latter falls into a long narrow pit, about 2 ft. deep, the end of which is closed in, allowing the stuff to escape only by four or five augur holes, one above the other. The heavier portion, again concentrated by this process, becomes deposited at the end of the pit nearest to the buddle. A man stands over this pit and passes an American broom very lightly backwards and forwards over the sand as it settles. The pit gradually fills, when the upper portion for a length of about 18 in. is put through the ordinary amalgamating barrel; 18 in. below that again is passed a second time over the buddle, and the balance is thrown on one side into the waste tailings heap. The man in charge of this process seemed perfectly at home at the operation, having had a great deal of similar experience in tin streaming in Cornwall. There the concentration is carried on to a much greater degree, so much so that brushes made with feathers are used to pass over the stanniferous sand, as an ordinary broom would be far too coarse for the purpose. This excessive care is not necessary with auriferous sand, owing to the system of amalgamation that can be adopted, a process not available where tin has to be collected. A fortune will be made out of the sludge channel yet.—*Dicker's Mining Record, Melbourne.*

APPLICATION OF ELECTRICITY IN THE MANUFACTURE OF STEEL.



The continually increasing application of steel to general manufacturing purposes causes much interest to attach to any proposition having for its object the reduction of the cost of production and the improvement of the quality of the article manufactured. Mr. Wm. Gerhardt, of Philadelphia, has invented an extremely simple process, and as the invention has attracted much attention in the United States, and as it is proposed to dispose of the English, French, and Belgian patents, a detailed description of the mode of working may not be uninteresting. It is claimed that the peculiar manner of applying magnetism enables the manufacturer to make steel of extraordinary strength, and that the whole process will bear very favourable comparison with the Bessemer process—the expense and results being far more certain; whilst the steel made is in every way equal to that of Krupp, of Essen. The inventor, a Prussian gentleman, some 60 years of age, is an old pupil of Frauenhofer, of Munich, and has devoted his whole life to scientific pursuits. The invention has several distinct features, though all have more or less relation to each other.

In the first place, wrought-iron scraps, already highly heated when the oxide is introduced, are melted, or nearly melted, by the increase in the intensity of the heat caused by the liberation of the oxygen gas, and the cast-iron on its introduction combines almost instantaneously with the wrought-iron, the latter taking from the cast-iron its carbon, so that when distributed among the whole mass, the latter will be carbonised. The amount of oxide is so proportioned that any excess of carbon which may exist in the cast-iron above that necessary to form the steel will combine with the oxygen gas liberated from the oxide, and pass off with the products of combustion. By increasing the proportion of oxide of iron, the steel may be decarbonised to such an extent as to reduce it to wrought-iron. It will, of course, be understood that the steel may be greatly varied in quality, by the introduction of other substances in connection with the oxide of iron, as, for instance, by using the oxides of chrome, tungsten, or titanium, for producing a hard steel, or by simply increasing the oxide of iron and wrought-iron for making a soft steel. Although the above-described manufacture can be conducted in differently constructed and arranged apparatus, those which we are about to describe are to be preferred.

In the accompanying drawing, Fig. 1 illustrates apparatus for conducting the manufacture on a large scale, and constituting a second feature of the invention. *A* is a reservoir of fire-proof material, supported on pillars, *a a*, and inclosed in a furnace *B*, into which the blast is introduced at two points through the tuyere *C*, *a′ a′* being the outlet openings through which the blast passes to the chimney, *D*. The covers, both of the furnace and reservoir, are detachable, so that the scraps of iron may be introduced into the latter; smaller openings being made in both covers, for introducing the oxide, or molten pig metal. After the introduction of the pig metal the entire mass is maintained in a heated state for from one to two hours, according to the quantity of metal in the reservoir, and when the process is completed the steel is permitted to run out through a tapping hole at the side of the furnace. For the manufacture of finer qualities of steel it is preferable to use the apparatus which constitutes a third feature in the invention, and which is illustrated in Fig. 2, where *A*, *A*, *A* are crucibles inclosed in the furnace, *c*, and above these crucibles is a conductor, *D*, having an opening over the mouth of each crucible, through which the stream of molten pig-iron from the cupola, *E*, falls into the wrought-iron in the crucibles. It is sometimes desirable that the cupola should be moveable, for which purpose flanged wheels, *h*, running on rails, *i*, are hung to the side of the supporting framework, *F*, of the furnace.

Another feature of the invention consists in a peculiar manner of constructing and arranging furnaces for heating the crucibles and melting the contents. This is illustrated in Fig. 3. A, A', A'', A''', are a series of furnaces, supported by the masonry, *B* in which are the arched way, *C*, and arched passage, *D*. A passage or flue, a', forms a communication between the top of the furnace, *A*, and that of the furnace, A', a similar flue, *a*, forming a communication between the lower end of the furnace, A', and that of the furnace, A'', and a third flue, a'', forming a communication between the upper portion of the furnace, A'' and that of the furnace, A''', while a fourth flue, a''', communicates from the lower portion of the furnace, A''' to the chimney, *F*. Beneath the furnace, *A*, is an ash-pit, *E*, into which, through an opening, *e*, the blast is introduced, the ash-pit having an inclined floor, from the edge of which projects a plate, *c*, into the arched way, *C*. A drying oven, *G*, with perforated shelves, *d*, is erected directly over the flue, a''', and so that the chimney, *F*, shall pass up one side of the oven, an opening, *g*, near the top of the oven communicating with another chimney, F'. Over the furnaces, *A*, &c., is suspended the railway, *H*, slightly inclined downwards from the chimney, *F*, and on this railway runs a car, *I*, from pulleys on which are suspended the automatic tongs, *J*. Near one end of the masonry, *B*, is a casting-pit, *K*, for containing the mould; C' is a truck, having wheels adapted to rails laid on bottom of the arched way, *C*. By the arrangement of the furnaces above described many advantages are to be obtained, one of the most important of which is the saving of fuel, by utilising the heat which passes from the first furnace, *A*, and which instead of immediately escaping to the chimney is conducted through the flue, a', to the top of the furnace, A', through which it passes in the direction of the diagonal line, *x*, to the flue, *a*, which conducts it to the bottom of the furnace, A'', and through which it passes up to the flue, a'', and to the top of the furnace, A''', and out of the latter into the flue, a''', and thence into the chimney. The products of combustion in thus taking a diagonal course through the several furnaces, and taking the diagonal of the crucibles, a gradual heat will be conducted through the furnaces, and communicated to the crucibles, and finally impart heat to the oven, *G*, for drying new crucibles. When it is necessary to remove a crucible from one furnace and deposit it in another, a cover, *b*, is removed, and the car, *I*, is brought over the furnace, so that the automatic tongs, *J*, can be lowered to grasp the crucible; when the latter is raised it can easily be moved to another furnace, by pushing the car, *I*. By this means also the crucibles containing the molten metal from the furnace may be conveyed to the pit, *K*, which contains the moulding flasks for the reception of the molten metal. The ashes are conveyed from beneath the furnace by opening the door, *y*, and permitting them to slide down the incline floor on the plate, *c*, into the car, c'. By combining and arranging the furnaces as thus described, not only is there a great saving effected in the amount of fuel, by utilising the heat which generally passes up the chimney, but the arrangement is such that both labour and time are economised by bringing all the parts necessary to carry on the operations so intimately together. It will also be apparent that a series of furnaces, constructed as described, may be arranged side by side, the arched chamber, *D*, and the archway, *C*, extending under the entire series, thus greatly increasing the facilities for carrying on extended operations within a contracted space.

In connection with the moulds used in the last-described apparatus, or in connection with the separate moulds, may be practised the mode of applying magnetism in the manufacture of steel, which constitutes the fifth feature in the invention. The molecular structure of steel will be altered by passing through the same while in a molten state in the moulding flask, and before it has cooled, a current of magnetism. This is not only the case with steel while in a molten state, but even the solid armatures, kept for a length of time in contact with the poles of a powerful magnet, have changed their molecular texture under the influence of the magnetic force. When steel (or any other substance susceptible to magnetic force) is magnetised while cooling in the mould, the crystals wedge into each other in the direction of the magnetic current, and give to the whole mass a lamellar, tough, and strong texture. Another advantage, also, is that all lateral crystalisation is prevented by the action of the magnetic force, which maintains the molecules of the crystals in a longitudinal direction. To obtain the desired effect, a powerful electro-magnet is applied to the flask containing the molten steel, as seen in Figs. 4 and 5, where Fig. 4 is a side view of the car supporting the magnet, and Fig. 5 a front view of the same. *A*, is a truck, to which are hung the wheels, *a a*, and to the top of this truck is secured a standard, *b*, and to the upper end of the latter is jointed so as to revolve readily a plate, *B*, in each end of which is cut a longitudinal slot, *c*. Through each projects the screwed end of a bar, *C*, of soft iron, around which is coiled an isolated copper wire, *x*, the latter leading to one of the poles of a battery, *D*, on the truck. The bars, *c*, are held in their position by nuts, *b*, which may be lowered to allow the bars to be adjusted on the plate. The flask, *E*, containing the casting, is mounted on a block, *G*, so that the ends of the bar, *c*, may be each as near to its end of the flask as possible. The connection between the two bars being thus established by the flask, the magnetism generated in the bars by the current of electricity passing through the coils which surround them, passes also through the molten steel, which lies within the circuit. By means of the movable plate, *B*, and the slots in the same, which permit the adjustment of the bars, *c*, they may be readily applied to almost any form of flask.

The invention further relates to the introduction of oxides of iron, and other solid substances containing oxygen, in molten iron, for the purpose of decarbonising the same in order to strengthen it, or reduce it to cast-steel or wrought-iron. Figs. 6 and 7, illustrate apparatus for accomplishing this result. In Fig. 6, *A* is the crucible containing the molten metal to be decarbonised; *B*, is a sheet-iron cylinder, to the head of which is attached the end of the tube, *a*, through which and through the cylinder passes a rod, *b*. To this rod is attached a disc or plate, *d*, which fits the inside of the cylinder, and occupies a position at the upper end of the same, and to the lower end of the rod, *a*, is secured a somewhat larger plate, d'. The space in the cylinder between the two discs, *d* and d', is filled with oxide, and the rod, *a*, grasped with the hand, and the entire cylinder forced into the molten metal in the crucibles. In a few moments the lower disc will have burned away, when the wire, *b*, is pushed down, so as to force the disc, *d*, along the cylinder, expel from it the oxide into the metal at the lower part of the crucible, so that it may become thoroughly incorporated with the same. The cylinder, *B*, may be dispensed with, and a solid cylinder of oxide of iron may be introduced into the crucible, the oxide being solidified by a small portion of clay and lime. The advantages which result from this feature of the invention are manifold. As it is very important to obtain cast-iron of great strength and close texture, many means have been resorted to to increase its tenacity. The most successful of all devices heretofore invented for this purpose (that of abstraction of carbon by injection of air) requires complicated apparatus, and consequently greater outlay. In the present instance the same result is accomplished in much less time, with a mere nominal expense, without danger, and with a precision that none of the known processes present. The amount of carbon that has to be oxydised in order to obtain iron of a certain strength can be previously ascertained, and the corresponding quantiry of oxygen may be calculated, and introduced in the form of oxides; when the process is applied to steel the same can be rendered softer, even during the last heating moments in the crucible, because the reducing material, as well as that to be reduced, can be fully controlled and exactly calculated, an advantage that has never been obtained heretofore. When the iron and steel to be decarbonised contains sulphur or other impurities, such substance or substances should be mixed with the oxides as can combine with the same, pass off as a vapour, or unite with the covering flux. For instance, if a small portion of chloride of sodium or calcium, or lime, or any other substance having the desired properties, be mixed with the oxides, the chloride will extract the sulphur, pass off partially as chloride of sulphur, whilst the rest will be kept by the flux covering the steel or iron. A modification, when a slower oxidation is desired, is shown in Fig. 7. It consists of the vessel, A', covered with a lid, *a*, of convenient shape and size, constructed of fire-clay, or other fire-proof material, which, however, must be free from any carbonaceous substance, such as plumbago, coke, &c. This vessel or crucible is pierced with numerous holes, and is filled with black oxide of manganese, or other solid substance containing oxygen, and submerged in the steel. The lid of the crucible containing the molten metal will hold the small vessel below the surface of the metal, allowing the slow escape of the oxygen through small holes into molten steel, whereby a gradual decarbonisation is effected. The advantage of this apparatus consists in using the pure oxygen gas, keeping the remaining substances from coming in contact with the steel or iron.

The last, and certainly not the least, important feature of the invention consists in a mode of ascertaining the quality of steel manufactured, the said mode being also applicable to the production of sound steel castings of pistol barrels and other like objects. One form of apparatus for carrying out this mode is illustrated in Fig. 8, where, *A*, is the clay mould screwed to a r d. *a*; *x x*, are the openings through which the metal contained in the crucible, A', runs into the mould. The moulds are prepared of the best fire-proof and refractory material, as, for instance, soapstone, fire-clay, &c., in the same manner as ordinary fire-bricks and crucibles are prepared. The moulds thus prepared are arranged so that they will be filled through openings in the side near the top, and have also a cavity and air-holes for the escape of flux and gas. On dipping the mould below the surface of the molten metal it flows into the openings and entirely fills the cavity. The moulds are then withdrawn from the crucibles, and allowed to cool gradually in an annealing oven. The importance of obtaining accurate test castings is well known to those engaged in the manufacture of steel. These test pieces have been heretofore obtained by taking the crucible from the furnace and pouring a portion of the steel into heated cast-iron moulds. The instantaneous absorption of heat causes a strong contraction of the interior of the test piece. By this mode of obtaining test pieces no sudden contraction of the interior particles takes place, the mould being filled with the metal while in its most liquid state, and the metal being allowed to cool gradually and equally, a process which results in the obtaining of accurate test pieces. It will be observed that the above mode of obtaining accurate test pieces may be applied to the productions of steel castings of a variety of objects, such for instance as rifle and pistol barrels.

It is estimated, even taking the high price of materials ruling at Philadelphia, that the cost of building furnaces, cupola, forge and smithy, and crucible making apparatus, will not exceed 2000*l.* ($10,200), not including ground, buildings, steam, and motive power. The cost of material and labour for making 2 tons of steel with anthracite coal and self-made crucibles will not exceed 4d. per lb. at Philadelphia, and it is estimated that 500*l.* per week profit may be realised. The motive power required will be a 15-horse engine, with an addition of steam equal to the amount required to propel a 10-horse power engine. The furnaces are in series, or sets, four furnaces constituting one series, and one fire heating a set; the first furnace only of each set having a fire arrangement, the other three being heated by the unexpended heat of the first furnace of the set.

NOVELTY IN SHIPBUILDING.—Some few years since Messrs. Winan invented and constructed a boat, which was tested in American waters, the configuration of which so nearly resembled that of a cigar that it was universally known as the "cigar ship," and it appears that Mr. Winan has now so far perfected the invention that he has come over to this country to introduce it. Mr. Winan's new ship is being constructed at the shipbuilding-yard of Mr. Hepworth, near Poplar, and her dimensions will be—length over all, 256 ft., and her greatest width and depth is in the middle, where the circle is 16 ft. diameter. The material used is Low Moor iron and steel, the thickness of the plates being ⅝ in. below the water-line, and 5-16 in. above it. Her displacement is about 500 tons, and her burden somewhat over 300 tons. In place of a keel, she has a 1-in. plate of iron, 3 ft. wide, and the plates are fitted to such a nicety that the outside is perfectly smooth. It is estimated that she will be propelled at 30 miles an hour by her two screws, with eight blades each, and of 22 ft. diameter. The engines are of the three-cylinder class, and are to drive one steel shaft, with which 16 ft. of each end of the vessel also revolves. Her boilers are on the locomotive principle, with vertical tubes, and are to work at 150 lbs. pressure on the square inch, and he has made arrangements for burning over 3 tons of coal per hour, which, it is estimated, will give him 2500 horse-power. It is claimed that, as regards motion at sea, rolling and pitching will be reduced to the minimum, as will be fully proved in August, when the ship will be ready for sea.

THE OPERATION OF THE PATENT LAWS, WITH SUGGESTIONS FOR THEIR BETTER ADMINISTRATION.—Under this title Mr. A. V. Newton has just issued, through Messrs. Trübner, of Paternoster-row, an answer to the objections urged against the principle of patent law protection. After considering the reasons advanced for abolishing patents, the rewards proposed in substitution of patents, and the remedy for the present defective system of adjudication, Mr. Newton deals with the question of compulsory licenses, and remarks that the right of manufacturers and others to claim, as representatives of the public, to use a patent on payment of a proper remuneration is one that might be judiciously conferred, and that greatly to the benefit of patentees. Mr. Newton has evidently given great attention to the subject, and has succeeded in advocating the cause of inventors with great force and judgment.

GEOMETRICAL DRAWING.—There is, perhaps, no greater acquisition to a manager of works or superior workman than a knowledge of geometrical drawing, and the ability of those requiring a machine, a portion of a machine, or a building, to sketch intelligibly very frequently saves much unnecessary outlay, that might otherwise arise through misunderstanding on the part of those by whom it is to be constructed. Under the title of "An Elementary Treatise on Orthographic Projection and Isometrical Drawing," a new shilling volume of Gleig's School Series, by Mr. W. S. Binns, M.C.P., has just been issued by Messrs. Longman, which cannot fail to prove of great utility to all engaged in the mechanical arts; and if the book be studied as it deserves to be there can be no treatise of the series likely to produce better results among the industrial classes.

MINING AND METALLIC PRODUCTION IN THE UNITED STATES.—An interesting little history of the progress of mining enterprise in America appears in the "American Mining Gazette" for April, wherein it is remarked that in every part of the globe, with the exception, perhaps, of Great Britain, there appears to be a great failure to direct a due share of the industrial productive power to the wealth hidden beneath the soil. The excavations of metallic substances in America dates in some sections from the earliest settlement of Europeans, but the results prior to the gold yields of California cannot be considered as affording incentives to steady mining pursuits, except in the case of iron. In the manufacture of zinc and its oxide American manufactures have made some contributions to practical metallurgy; especially has this been shown in the profitable production of the metal from silicate of zinc, with a slight admixture of the carbonate, through the use of anthracite in muffles of American clay. There is no tin mine within the United States. Some crystals of the oxide have been found. The ore occurs in three or four small veins in mica-slate at Jackson, New Hampshire, and in some sections of California there are reported concentrations of the metal, which may, it is inferred, be worked with advantage.

FOREIGN MINES.

ST. JOHN DEL REY.—The directors have received, by telegram, from Lisbon, the following, dated Morro Velho, April:—Produce for March, 32,106 oits.; cost for ditto, 11,276*l.*; profit for ditto, 1426*l.*; produce 10 days of April, 8764 oits.; yield, 4·897 oits. per ton. Short hauling, machines otherwise occupied.

ALAMILLOS.—May 7: The ground in the cross-cut driving south, in the 4th level, is very hard for driving. In the 3d level, west of San Lino shaft, the ground is easy for driving, and contains some small branches of lead, but not sufficient to value. The 3d level, east of Zamora's winze, is being driven to meet the last-named end. In the 3d level, west of footway-shaft, the lode is still disarranged. The lode in the 3d level, east of Aguilar's winze, produces some small stones of lead occasionally, but not enough to value. In the 2d level, east of Taylor's shaft, there is now a large floor of decomposed granite and clay, running almost horizontal; the lode is injured in consequence. The lode in the 2d level, west of same shaft, maintains its size and regularity, but has not yet improved in point of productiveness. The upper part of the end of the 1st level, west of San Eugenio shaft, is holed to the old workings, while in the bottom the lode is of a kindly appearance. The 1st level, east of same shaft, having been holed to the old excavations, will remain suspended until a horse-whim is erected to draw away the stuff.—Shafts and Winzes: In Taylor's engine-shaft, sinking below the 2d level, the men will finish the plat in the coming week, when preparations will be at once made for sinking. In San Rafael shaft, below the 3d level, the plat is completed. A penthouse will be put in, and sinking for a 4th level commenced forthwith. In Crosby's shaft, sinking below the surface, the water is getting too much for the men to keep out, and the engine will be got to work on this and San Jose shaft as early as possible. There is a very fine lode in the eastern end of San Martin shaft, sinking below the 2d level, worth at the rate of 2 tons per fm. In San Francisco shaft, sinking below the surface, the men are making good progress, and we expect to find the lode shortly. The lode in La Madelena shaft is of a promising character, consisting of gossan, soft granite, and lead, worth for the latter 1 ton per fathom. San Adriano shaft, which is west of Taylor's engine-shaft, and at a suitable distance to be made available for a whim-shaft, is off the main lode, but will only require a short cross-cut to intersect it.—General Remarks: The surface work is being pushed on as fast as possible. The masons are engaged about the captain's house and office, and the carpenters are preparing the woodwork for the same. The shears and balance-bobs for San Jose and Crosby's engine-shaft are nearly completed, and will be erected very shortly.

LINARES.—May 6: West of Engine-Shaft—South Lode: In the 110 west of the engine-shaft, the lode is getting small. The lode in the 95, west of No. 129 winze, is improved, being very compact and firm, and worth 1¼ ton per fm. In the 85, west of Mario's winze, the cross-cut is very hard for driving. In the 61, east of Isidoro's winze, the lode is very large, but entirely without lead. In the 61, west of Santana's winze, there is still a splendid course of ore, worth 8 tons per fm. The lode in the 51, west of Crosby's shaft, has fluctuated considerably of late, both in bearing and produce.—East of Engine-Shaft: In the 110, east of engine-shaft, the lode is large and hard for driving. The lode in the 95, east of Shaw's shaft, is large, consisting chiefly of carbonate of lime. The lode in the 85, east of No. 124 winze, is producing some very good stones of lead.—North Lode: In the 85, east of No. 132 winze, there is a very large, strong, and promising lode, but not so rich as we expected to find it. The lode in the 85, west of Ortego's winze, has declined in value. In the 75, east of Field shaft, there is still a good lode, worth ½ ton per fm.—Shafts and Winzes: At Crosby's engine-shaft the men are getting on well. In No. 135 winze, below the 85, the lode is large, containing spots of lead. In No. 136 winze, below the 85, there is a very compact and promising lode, worth 1 ton per fathom. The lode in No. 137 winze, below the 65, is very wide, and spotted throughout with lead. In No. 138 winze, below the 95, the lode has declined in value, and the ground is getting harder for sinking. In Rendon's winze, below the 41, there is a very kindly branch of lead on the south wall of the large lode. No. 139 winze is situate east of No. 132 winze, and in advance of the 85, on the north lode.—General Remarks: There is no unusual alteration in the tribute department. The machinery is in good working order, and the surface work generally is being carried on with regularity. We estimate the raisings for May month at 375 tons.

FORTUNA.—May 7: Canada Incosa—West of Taylor's Engine-shaft: The lode in the 100, west of Gonzale's winze, is very changeable, and has declined in value during the last few days. In the 90, west of Zamora's winze, the ground is remarkably hard for driving. In the 80, west of Henty's shaft, the lode is of a very open and promising appearance. The lode in the 70, west of Judd's shaft, is very compact and firm, and opening out good tribute ground, worth 2 tons per fathom. In the 55, west of Carile's winze, the lode is small and poor.—East of Engine-shaft: In the 70, west of Lownde's shaft, there is no improvement to notice. In the 70, east of same shaft, the lode continues small and poor. In the 55, east of Pascual's winze, the lode is very small, and the ground hard for driving. The lode in the 45, east of José's winze, is improving, and is now worth 1 ton per fathom. In the 30, east of Domingo's (now Garcia's) winze, the lode is very regular, and we expect it will improve again shortly.—Shafts and Winzes: O'Shea's shaft is being sunk through a fine, strong, and rich lode, worth 5 tons per fathom. The lode in Testero's winze, below the 55, is very firm and regular, worth 2 tons per fathom. Lopez' winze, sinking below the 70, is likely to open out a valuable piece of tribute ground. In Damian's winze the lode is small and unproductive.—Los Salidos Mine: In the 90, west of Morris's engine-shaft, there is a strong kindly lode, worth 1½ ton per fathom. The 75, west of Sanchez' winze, is of a very promising and productive character. The lode in the 65, west of Buenos Amigo's shaft, is large, consisting of decomposed granite, spotted throughout with lead. The 55, west of Galinda's winze, has opened valuable ground during the past month, and there is still a splendid lode in the back of the end, worth 2 tons per fathom. In the 45, west of San Carlo's shaft, the men are still rising against Millan's winze; the lode is small and hard. The 30, west of same shaft, is holed to old workings, the extent of which is not known.—East of Engine-shaft: In the 90, east of Morris's engine-shaft, the lode has a very promising appearance, and yields fine lumps of lead. The lode in the 75, east of Delgada's winze, shows indications of improvement. The end is suspended for the present while the men clear out the stuff. In the 65, east of Viciana's winze, there is a slight improvement. In the 55, east of Parra's winze, the lode is very small, and the granite getting harder for driving through.—Shafts and Winzes: San Miguel's shaft is holed to the 55 fm. level, and made available for drawing away the stuff. In San Gabriel's shaft the ground is hard and lode small, and underlying very fast. San Carlo's shaft is going down in a splendid lode, worth 3 tons per fathom, and will be holed to the 55 fm. level in a few days. We have commenced sinking San Enrique's shaft for the second level; it is now in old workings. Andre's winze is holed to the 90 fm. level. In Miguel's winze the lode is greatly improved, being of a strong and kindly appearance, worth 2 tons per fathom. In Pentado's winze the men are making good progress, and the lode is looking kindly. Suez' winze is going down in a strong and productive lode, worth 2 tons per fathom.—General Remarks: The tribute department is looking moderately well. The surface work is proceeding with its usual regularity. We estimate the raisings for May month at 400 tons.

CENTRAL AMERICAN.—Alotepeque, March 31: San Pantaleon Mine: Cornubia engine-shaft is now being sunk to the 50 fm. level below the Dolores adit; the shaftmen are now engaged in securing the shaft in this level preparatory to driving east and west. The lode here at present is 2 ft. wide, composed of calc-spar and decomposed porphyry, with a little black mundic. Taylor's engine-shaft has been sunk to the depth of San Alfonso, or the 40 fm. level, and the men have commenced to drive west towards the San Alfonso deep adit; the ground is rather hard. San Alfonso, or the 40 fm. level, east of Cornubia shaft, has been driven north towards the main lode, or heaved part, 5 fathoms on No. 2 cross-course; it will take us about two months more to cut the lode at this point. In San Alfonso, or the 40, west of Cornubia engine-shaft, the lode is 18 in wide, composed of flookan and calc-spar, with a small branch of silver ore, worth of the latter 1 or 2 cwts. per fathom. In San Felipe, or the 30, driving east, the lode is 6 in. wide; this level for the last 26 fathoms has been driven through unproductive ground, with the exception of two or three places, where we had small pockets of ore. In San Ricardo, or the 20, the lode driving east of No. 2 cross-course is much disordered by its near approach to No. 3 cross-course. In San Alfonso deep adit level, driving east towards Taylor's shaft, the ground in the end in the past month has much improved for driving; in consequence of a cross lode, or course, coming in and crossing the level, this course is 5 ft. wide. The lode in the stope No. 11, above San Alfonso level, west of Hosking's winze, is worth 3 cwts. per fathom of silver ore. The lode in the stope No. 2, about San Felipe level, and east of No. 1 winze, is 1 ft. wide, worth 6 cwts. of good quality silver ore per fathom, but we regret to say that this stope will be finished in two or three days more; this has been one of our best stopes for the last four months. The stope No. 3, above San Felipe level, and west of No. 2 winze, is worth from 3 to 4 cwts. of silver ore per fathom of low quality. Stope No. 10, below San Ricardo level, and east of No. 3 winze, is worth 7 cwts. of good quality silver ore per fathom. Stope No. 9, below San Juan level, west of No. 4 winze, is worth 4 cwts. of silver ore per fathom of low quality; this stope is almost finished. Stope No. 12, above San Felipe level, and east of No. 2 winze, is worth 3 cwts. of low quality silver ore per fathom. Stope No. 7, below Dolores adit level, is suspended, and we have put the men to clear up the bottom of San Damasio level, east of the attle winze; here the lode is 10 in. wide, and worth 4 cwts. of silver ore per fathom.—San Antonio Mine: The lode in San Faustino, or 10 fm. level, below San Ramon adit level, east of Ellery's whim-shaft, is 18 in. wide, composed of flookan and quartz, with spots of ore, but nothing to value. The lode in the same level, west of the shaft, is split into branches, and is very hard for driving through. We thought it necessary to suspend the driving of this level west for the time being, and we have put the men to sink a winze below San Ramon level, east of No. 1 cross-course, where the lode is worth 3 cwts. of silver ore per fathom, but of low quality. The lode in the stope No. 1, west of Mistum's winze, is worth 3 or 4 cwts. of low quality silver-lead ore per fathom.

April 2: Since the last date no improvement has taken place in the mine of San Pantaleon, but in San Antonio a course of ore, 9 or 10 inches wide, has just been met with in the eastern end of San Ramon, worth about 3 tons per fathom, but of low assay for silver. Our works generally proceed with their accustomed regularity, and I am only sorry it is not in my power to furnish a more cheering account of what they have produced. The ore returns from both mines amount to 118 tons 12 cwts., the yield of only three weeks' work, as the Easter holidays, as usual, interrupted our operations for a full week. I believe our present rate of returns is equal to cover the expenditure, but inasmuch as a reduction is being effected throughout the establishment, I am not without hope of seeing a profit on the coming month's operations. The discovery alluded to in the mine of San Antonio, to the east of the cross-course in the deep adit level, may be looked on as important, although the ore may be at present of rather low assay, when it is considered there are some 45 fms. of virgin ground between the point referred to and surface, and San Faustino level, 10 fms. below, is within 20 fms. of it.

THE GOLD-DIGGING IN NEW SOUTH WALES.—The amount of gold received at Sydney (New South Wales) Mint in 1851, the first year of the gold discoveries, was 161,880*l.*, and in 1863 it amounted to 422,722*l.*

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